Atmospheric conditions during Smithsonian observations, November 1936

Date	Time from apparent noon	Temperature °C.	Wind, Beaufort	Visibility	Sky blueness	Cloudiness and remarks
Nov. 1	1:56 p. m.	+15.9	SW 4	8	7	Few Ci, 1 Acu, light haze, instr. indoors.
5	3:29 p. m.	+7.5	NNW 5	9	7	Few Ci, 1 Cu.
9	0:17 p. m.	+5.6	NW 2	9	7	1 Cu, light haze.
9	2:55 p. m.	+7.2	W 1	9	8	Few Ci, light haze.
10	2:21 p. m.	+7.3	W 1	9	8	Few Cu, light haze, instr. indoors.
11	1:17 a. m.	−0.2	WNW 4	9	8	Zero clouds, light haze, instr. indoors.
12	2:54 a. m.	+3.1	SW 4	6	7	1 Ci, moderate haze.
13	2:02 a. m.	+5.3	N 4	5	6	Zero clouds, dense haze.
14	2:33 a. m.	+3.6	S 5	6	7	Few Ci, dense haze, instr. indoors.
15	0:21 a. m.	+9.1	W 4	8	7	Few Cu, light haze.
18	1:35 a. m.	−6.7	NNW 7	9	7	Few Acu, light haze, instr. indoors.
19	1:00 a. m.	−6.8	NW 6	9	7	Do.
21	3:00 a. m.	+6.7	SW 3	6	7	Few Ci, 2 Acu, moderate haze.
21	3:17 p. m.	+14.2	W 4	7	7	Few Ci, Few Acu, moderate haze.
23	2:08 a. m.	−4.2	WNW 5	9	7	Few Cu, light haze, instr. indoors.
23	0:35 p. m.	−1.9	NW 5	9	8	Few Cu, light haze, instr. indoors.
26	1:50 p. m.	−0.8	WNW 5	8	7	Few Acu, few Cu, light haze, instr. indoors.
27	3:10 a. m.	−7.5	WSW 3	7	7	Few Ci, few cu, light haze, instr. indoors.
27	1:43 p. m.	−4.6	W 4	8	7	Do.
28	3:09 a. m.	−8.8	S 3	7	7	Zero clouds, moderate haze.
30	3:51 a. m.	−7.7	W 4	8	7	Few Stcu, Frcu, Cu, light haze.

POSITIONS AND AREAS OF SUN SPOTS

Note.—The report for December 1936, not having been received in time, will be included in the January 1937 issue of the REVIEW.—*Ed.*

PROVISIONAL SUN-SPOT RELATIVE NUMBERS, NOVEMBER 1936

[Dependent alone on observations at Zurich and its station at Arosa]

[Data furnished through the courtesy of Prof. W. Brunner, Eidgen, Sternwarte, Zurich, Switzerland]

November 1936	Relative numbers	November 1936	Relative numbers	November 1936	Relative numbers
1	*d* 118	11	*Eac* 148	21	28
2	*a* --	12	*aa* 133	22	*b* 39
3	*Eac* 149	13	*a* --	23	*d* 46
4	*ad* 140	14	*ab* --	24	43
5	159	15	119	25	*Ecd* 70
6	*Eacd* 151	16	95	26	96
7	*ad* 127	17	*Ec* 92	27	*d* 141
8	*Ecd* 140	18	61	28	*Ec* 212
9	127	19	60	29	*ab* 192
10	150	20	---	30	---

Mean, 25 days=113.4.

a=Passage of an average-sized group through the central meridian.
b=Passage of a large group or spot through the central meridian.
c=New formation of a group developing in a middle-sized or large center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central circle zone.
d=Entrance of a large or average-sized center of activity on the east limb.

AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE in charge]

By L. P. HARRISON

Mean free-air temperatures and relative humidities for November, as determined from airplane weather observations, are given in table 1. The "departures from normal" given in the table are based on "normals" derived from the number of observations indicated in the note at the foot of the table, where the number of years over which the observations were taken are given by the figures in parentheses. In general, the numbers of observations available for computing "normals" for the higher levels are less than those available for the lowest levels (represented by the data given in the footnote). To compensate for this discrepancy, the "normals" are obtained by applying the mean differences between the successive standard levels to the data for the lower levels, where the "normal" for the surface based on the indicated number of observations serves as the reference basis. The "normals" in each case include the data for the current month. It will be noted that many of the "normals" are based on only 3 years of observations. "Departures from normal" in such cases must be regarded as having little weight in comparison with departures from "normals" based on much more extended periods of record (35 or more years, say, which are not uncommon in climatology).

The mean temperatures for the month at the surface (see chart I) were generally below normal in the eastern half of the country, and in most of Texas and southern New Mexico, as well as in a large part of the extreme northwest portion of the country with the exception of northwestern Washington, which had above-normal temperatures. The largest negative departures from normal at the surface were to be found in the Great Lakes region and southward for several hundred miles, with an average of about −2° C., and also in the northern half of the extreme northwest portion of the country (excepting northwest Washington) with an average of nearly −3° C. The remaining portion of the country and southwestern Canada largely had above-normal temperatures at the surface, with maximum positive departures to be found in the southern California coast region, and notably in southwestern Canada where the average departure from normal appeared to be slightly over +4° C.

The mean temperatures for the month in the free air (see table 1) appeared to show that the significant negative departures from normal observed at the surface near and somewhat to the south of the Great Lakes region were not merely superficial but were also predominantly in evidence at all elevations up to at least 5 km in the northeast sector of the country, with perhaps the exception of the levels from 3 to 5 km near the coastal area adjacent to New York. (See Mitchel Field.) If we may regard the departures from normal given in table 1 as representative, the data for Selfridge Field (Mount Clemens, near Detroit), Mich., Wright Field (Dayton), Ohio, and Omaha, Nebr., indicate that departures from about −2° to −4° C., prevailed in the area under consideration.

The mean temperatures for the month in the free air also gave evidence that the extreme northwest part of the country at all levels up to 5 km, except the lowest stratum near the ground, was dominated by positive departures from "normal temperatures" ranging from 0° to a maximum of +4° C. This condition apparently was associated in some manner with the similar above-normal temperatures observed at the surface in southwestern Canada and northwestern Washington.

Mean free-air relative humidities for the month were slightly above normal in the extreme southwestern portion of the country at practically all levels up to 5 km, and also in the south-central portion at moderate and higher elevations (2.5 to 5 km). (Note departures: +5 percent to 8 percent at San Diego from 1.5 to 5 km; +7 to 11 per-

cent at Kelly Field (San Antonio) from 3 to 5 km). Elsewhere and at other levels the departures from normal relative humidities were largely of negative sign. The regions of most notable *below-normal humidities* could be more or less closely identified, respectively, with the Great Lakes-south central regime of *below-normal temperatures* referred to above, especially at moderate elevations (note departures from −13 percent to −17 percent at Wright Field (Dayton), Ohio, from 2 to 4 km, and the Oklahoma City departures), and perhaps, anomalously, also with the extreme northwestern regime of *above-normal temperatures* referred to in the preceding paragraph (note departures: −12 percent to −17 percent at Spokane from 1.5 to 5 km). The extreme northeast coastal area had significant negative departures from normal as evidenced by the data for Boston (ranging from −7 percent to −12 percent from 1.5 to 5 km) and for Mitchel Field (ranging between −5 percent and −12 percent from 1.5 to 5 km).

The free-air resultant winds based on pilot balloon observations made near 5 a. m. (seventy-fifth meridian time) during the month of November are given in table 2. Generally speaking, the resultant winds were largely normal in direction but slightly above-normal in velocity at practically all levels up to about 2 km above sea level in the region over the country east of a line extending from eastern Mississippi in the southeast to western Montana in the northwest. The largest departures in resultant velocities from normal were to be found concentrated in the northeast sector of the country, as exemplified by the data for Newark, N. J., with departures of +4.1 m. p. s. at 2.5 km, and Washington, D. C., with departures of +3.3 m. p. s. at 1.5 and 2 km. The most marked departures in direction of the resultant wind from normal in the region under consideration were to be found at Sault Ste. Marie, Mich., where orientations of nearly 40° clockwise (i. e., more from the north) occurred in the monthly resultant direction as compared with the normal.

Excepting the south-central part of the country near the surface, and the California coastal stations at practically all levels up to at least 2 km, the resultant wind velocities in the region of the country to the west of the line extending from eastern Mississippi to western Montana were generally below normal by slight amounts up to about 2 km above sea level, and the resultant directions were largely near normal. Most of the significant exceptions may be noted from the following comparisons (station; elevation, November 1936; resultant direction and velocity in m. p. s.; and in parentheses, normal resultant direction and velocity in m. p. s.): Houston, Tex., 500 m, 66°, 2.7 (163°, 2.6); 1,000 m, 326°, 0.7 (209°, 2.2). Oklahoma City, Okla., 500 m, 267°, 1.9 (205°, 2.7); 1,000 m, 311°, 4.4 (252°, 5.4); 1,500 m, 310°, 5.1 (273°, 5.7). Albuquerque, N. Mex., 2,000 m, 334°, 0.9 (296°, 1.7). San Diego, Calif., 1,500 m, 69°, 3.7 (359°, 1.5); 2,000 m, 64°, 4.2 (355°, 1.8). Oakland, Calif., 1,500 m, 72°, 2.7 (349°, 2.4); 2,000 m, 114°, 1.4 (344°, 2.6).

Above 2 km to perhaps 4 or 5 km, the resultant winds in the northern third of the country during November were in general slightly above normal in velocity, and nearly normal or oriented slightly clockwise with respect to normal in direction. At these elevations in the southern two-thirds of the country, with the exception of the extreme southeast and the California coastal areas, the resultant velocities for the month were in general slightly below normal and the resultant directions were as just indicated for the northern third of the country. In the extreme southeast, Pensacola, Fla., had normal directions but significant positive departures (about 4 m. p. s.) of velocity of the resultant winds at 3 and 4 km. Key West, Fla., had only slight departures of resultant velocity from the normal at moderate elevations (2–3 km), but had considerable departures from normal in direction (40° to 56° counterclockwise). The most radically marked departures from normal direction at the elevations from about 2 to 4 km prevailed at Oakland, Calif., as shown by the following comparisons (see preceding paragraph regarding arrangement): 2500 m, 164°, 4.8 (341°, 3.2); 3000 m, 187°, 4.0 (342°, 3.5); 4000 m, 195°, 2.4 (351°, 1.9). Thus the normal northerly resultant winds at these elevations were replaced by southerly resultant winds. At 5 km, the normal westerly resultant winds at San Diego were replaced by an easterly resultant, while other stations in the western part of the country showed significant clockwise departures of resultant direction from normal which ranged from about 45° to 60° in magnitude. Albuquerque, N. Mex., showed a remarkable negative departure in velocity at 5 km, as indicated by the following comparison (see above): 335°, 1.3 (287°, 7.4).

The observational data discussed above have added significance when regarded in terms of the sequence of meteorological events which occurred during the month of November. During the month in question, the weather of the country was largely dominated by the passage of one anticyclone after another, either of P_c or P_p origin or both. Many of the high-pressure systems moved southward from Canada into the Northwestern States and then curved to acquire an eastward motion across the country. (The above-normal resultant velocities in the northern part of the country noted above may be recalled.) Many of the Pacific HIGHS which reached the north-central part of the country seemed to be reinforced by cold P_c air moving from the Mackenzie River-Hudson Bay area. Accordingly, a frequent type of atmospheric cross section in the northeastern part of the country was P_c or N_{Pc} air masses overlain by P_p or N_{PP} air masses. These air masses of cold and relatively dry characteristics gave rise to the subnormal temperatures already referred to above. The polar air masses, especially P_p and N_{PP}, had associated with them unusually dry conditions at moderate elevations (ca. 2–3 km), leading to the conclusion that considerable subsidence had occurred therein to produce the dryness. The subsidence in question may help to explain the apparently above-normal temperatures observed at moderate and higher elevations over the extreme northwest part of the country. The relatively moist T_M air masses occurred generally only in the southeastern part of the country, owing to the southward displacement of the polar air masses. Thus, with the ordinary supply of moisture lacking, a deficiency of precipitation was observed over most of the country. Nearly normal or slightly above-normal precipitation occurred in several small regions, notably the area immediately near and to the south of the Great Lakes, South Dakota, and some south Atlantic States as well as other isolated places (see inset chart V). Precipitation was very deficient along the Pacific Coast, the weather of which was dominated by the successive HIGHS that reached the western Plateau region from Canada and also by the Pacific HIGHS which moved eastward across the coast. The air trajectories were accordingly such that the dry P_p, N_{PP} (and also mixtures of N_{Pc}) air masses reached the Pacific Coast region, instead of the more moist air masses from the middle Pacific Ocean at moderate and low elevations which usually are prevalent.

TABLE 1.—*Mean free-air temperatures and relative humidities obtained by airplanes during November 1936*

TEMPERATURE (°C.)

Station	Altitude (meters) m. s. l.																Number of observations
	Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure ftom normal	
Barksdale Field (Shreveport), La.[1] (52 m)	7.1		11.0		9.9		8.5		7.0		5.1		3.2		−2.0		−7.8		27
Billings, Mont.[2] (1089 m)	0.4	+0.1					4.7	+0.6	3.8	+1.2	0.9	+1.2	−2.1	+1.3	−6.4	+2.8	−13.0	+2.8	29
Boston, Mass.[1] (5 m)	1.0	−2.3	−0.2	−2.1	−1.9	−2.1	−3.1	−2.2	−4.8	−2.5	−6.6	−2.5	−8.5	−2.3	−13.3	−2.2	−18.7	−1.4	20
Cheyenne, Wyo.[2] (1873 m)	−1.2	+0.1							0.5	−0.3	1.6	+0.1	−1.0	+0.3	−6.6	+0.8	−13.4	+0.7	30
El Paso, Tex.[2] (1,194 m)	6.0						8.8		7.8		6.2		4.3		−1.0		−7.7		30
Fargo, N. Dak.[2] (274 m)	−5.7	−0.3	−3.2	+0.1	−2.9	−0.3	−2.9	−0.7	−3.8	−0.6	−5.6	−0.4	−7.6	−0.1	−12.2	+0.7	−18.3	+0.9	28
Kelly Field (San Antonio), Tex.[1] (206 m)	9.2	−1.8	13.0	−1.2	11.6	−2.0	9.9	−1.9	8.8	−1.2	7.3	−0.7	5.2	−0.5	−0.5	−0.1	−7.9	−0.4	25
Lakehurst, N. J.[3] (39 m)	4.0	−2.1	4.5	−1.8	3.0	−1.6	1.3	−2.0	−0.1	−2.0	−1.2	−1.4	−3.2	−1.6	−8.6	−1.9			25
Maxwell Field (Montgomery), Ala.[1] (52 m)	9.1	−0.9	11.2	−1.4	9.3	−1.9	8.3	−1.7	7.2	−1.2	5.7	−0.6	3.5	−0.6	−1.7	−0.1	−7.9	+0.3	24
Miami, Fla.[2] (4 m)	19.1		20.3		16.3		13.2		11.8		11.4		8.9		2.9		−3.2		30
Mitchel Field (Hempstead, L. I.), N. Y.[1] (29 m)	3.6	−2.2	3.7	−2.0	1.8	−2.1	0.6	−1.5	−0.2	−0.9	−1.2	−0.2	−2.6	+0.4	−7.2	+1.9	−12.4	+3.1	21
Murfreesboro, Tenn.[2] (174 m)	4.2	−2.2	5.7	−2.0	5.1	−1.8	4.4	−1.8	3.2	−1.7	1.3	−1.3	−0.6	−1.1	−5.7	−0.7	−11.4	−0.2	29
Norfolk, Va.[2] (10 m)	7.3	−1.6	7.4	−1.6	4.8	−2.1	3.6	−1.4	2.9	−0.3	1.1	−0.5	−1.3	−1.1	−7.0	−1.4	−13.0	−1.0	21
Oakland, Calif.[2] (2 m)	9.2		15.4		15.0		13.6		11.1		8.5		5.5		−0.8		−7.9		30
Oklahoma City, Okla.[2] (391 m)	4.9	−1.6	7.4	−0.5	8.8	−0.4	8.0	−0.5	6.2	−0.3	4.0	−0.2	2.0	+0.2	−2.9	+0.9	−9.2	+1.0	29
Omaha, Nebr.[2] (300 m)	−0.4	−1.6	1.8	−0.7	2.3	−1.5	1.9	−1.5	0.2	−1.9	−1.6	−1.8	−4.0	−1.8	−9.6	−1.5	−16.6	−2.0	30
Pearl Harbor, Territory of Hawaii[3] (6 m)																			
Pensacola, Fla.[3] (13 m)	10.9	−1.8	13.0	−0.4	11.8	−0.4	10.5	−0.2	9.7	+0.5	7.9	+0.8	5.4	+0.6	0.4	+1.0	−5.4	+1.3	27
Salt Lake City, Utah[2] (1288 m)	−2.0						2.7		3.1		2.0		−0.4		−6.1		−12.5		30
San Diego, Calif.[3] (10 m)	12.0	−2.5	17.6	+1.5	15.9	+0.4	13.1	−0.2	10.2	−0.6	7.3	−1.0	4.7	−1.0	−1.8	−1.2	−9.0	−1.4	30
Sault Ste. Marie, Mich.[3] (221 m)	−4.3		−4.9		−7.2		−7.8		−8.6		−10.1		−12.3		−17.1		−22.7		29
Scott Field (Belleville), Ill.[1] (135 m)	−0.5	−3.0	2.5	−2.4	3.0	−1.3	3.1	−0.7	2.4	−0.1	0.6	0.0	−1.9	−0.1	−7.3	−0.3	−13.4	−0.2	25
Seattle, Wash.[3] (10 m)	7.4		9.0		8.1		5.8		4.2		1.7		−0.2		−6.0				3
Selfridge Field (Mount Clemens), Mich.[1] (177 m)	0.2	−2.7	0.3	−3.6	−1.7	−4.1	−2.7	−3.8	−3.9	−3.7	−5.7	−3.5	−7.8	−3.5	−12.8	−3.4	−18.8	−3.5	29
Spokane, Wash.[2] (596 m)	−2.0	−1.0			2.1	+1.2	3.3	+2.5	3.3	+3.6	1.7	+4.2	−0.9	+4.2	−6.3	+4.2	−12.8	+4.1	29
Washington, D. C.[2] (13 m)	4.5	−1.2	5.1	−0.6	2.4	−1.8	0.5	−2.1	−0.3	−1.4	−1.5	−1.2	−3.0	−0.9	−8.4	−1.2	−14.6	−1.5	28
Wright Field (Dayton), Ohio[1] (244 m)	−1.0	−3.3	−0.6	−4.2	−1.5	−4.6	−2.2	−3.9	−2.9	−3.4	−3.9	−2.7	−6.3	−2.6	−11.1	−2.0	−17.2	−2.2	22

RELATIVE HUMIDITY (PERCENT)

Barksdale Field (Shreveport), La.	84		63		58		54		51		51		51		47		47		
Billings, Mont	65	0					52	−1	48	−2	49	−3	50	−4	47	−7	46	−7	
Boston, Mass	69	−4	65	−5	63	−6	53	−10	47	−12	45	−10	44	−9	43	−7	37	−12	
Cheyenne, Wyo	60	−2							57	−3	50	−3	48	−4	43	−7	43	−6	
Colo Solo, C. Z																			
El Paso, Tex	62						51		49		48		44		43		40		
Fargo, N. Dak	79	−4	71	−7	66	−5	55	−6	50	−4	46	−5	47	−3	44	−4	47	−1	
Kelly Field (San Antonio), Tex	84	−2	57	−11	57	−6	59	+1	55	+2	51	+3	47	+7	43	+7	42	+11	
Lakehurst, N. J	81	−2	74	−4	70	−6	68	−3	63	−1	54	−4	51	0	51	+4			
Maxwell Field (Montgomery), Ala	70	−9	54	−8	53	−6	49	−2	39	−6	32	−7	34	−2	36	+4	34	+3	
Miami, Fla	87		73		77		72		62		43		41		39		35		
Mitchel Field (Hempstead, L. I.), N. Y	82	−2	76	−1	71	−3	64	−6	56	−7	47	−8	37	−12	40	−5	30	−10	
Murfreesboro, Tenn	84	+2	71	−1	66	−2	52	−7	41	−7	37	−7	36	−3	36	−1	35	−2	
Norfolk, Va	74	−1	61	−4	58	−3	55	−3	47	−7	42	−5	41	0	42	+5	36	+3	
Oakland, Calif	81		49		38		31		28		24		22		20		21		
Oklahoma City, Okla	69	−8	62	−10	51	−10	45	−10	43	−9	43	−7	39	−7	36	−5	34	−5	
Omaha, Nebr	78	−2	70	−4	61	−3	52	−4	48	−2	44	−2	44	−1	42	−2	41	−2	
Pearl Harbor, Territory of Hawaii																			
Pensacola, Fla	80	−1	65	−6	59	−5	55	−4	44	−7	37	−8	35	−6	28	−6	25	−5	
Salt Lake City, Utah	79						60		50		44		41		38		36		
San Diego, Calif	73	+3	56	0	45	+2	41	+5	38	+7	36	+8	34	+8	33	+8	32	+7	
Sault Ste. Marie, Mich	75		78		80		70		64		61		58		56		58		
Scott Field (Belleville), Ill	81	0	66	0	58	−3	49	−5	43	−6	39	−6	39	−5	38	−5	38	−3	
Seattle, Wash	91		77		73		74		65		61		55		56				
Selfridge Field (Mount Clemens), Mich	77	−4	75	+1	74	+2	63	−4	55	−3	51	−2	51	0	53	+5	53	+9	
Spokane, Wash	85	0			69	−6	54	−12	48	−14	45	−16	43	−16	37	−17	38	−14	
Washington, D. C	71	−3	60	−5	62	+1	59	+1	49	−5	46	−4	38	−6	35	−6	36	−1	
Wright Field (Dayton), Ohio	85	+3	77	+3	65	−1	51	−8	38	−13	31	−17	28	−17	33	−13	39	−7	

[1] Army. [2] Weather Bureau. [3] Navy.

Observations taken about 4 a. m., 75th meridian time, except along the Pacific coast and Hawaii where they are taken at dawn.

NOTE.—The departures are based on normals covering the following total number of observations made during the same month in previous years, including the current month (years of record are given in parentheses following the number of observations): Billings, 87 (3); Boston, 102 (5); Cheyenne, 89 (3); Fargo, 86 (3); Kelly Field, 76 (3); Lakehurst, 78 (3); Maxwell Field, 78 (3); Mitchel Field, 70 (3); Murfreesboro, 87 (3); Norfolk, 135 (8); Oklahoma City, 86 (3); Omaha, 174 (6); Pensacola, 174 (9); San Diego, 187 (8); Scott Field, 69 (3); Selfridge Field, 77 (3); Spokane, 85 (3); Washington, 202 (12); Wright Field, 68 (3). (Departures from normal for Seattle are omitted from this summary because of the paucity of observations.)

TABLE 2.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during November 1936*

[Wind from N=360°, E=90°, etc.]

Altitude (m) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (309 m)		Billings, Mont. (1,088 m)		Boston, Mass. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192 m)		Cincinnati, Ohio (153 m)		Detroit, Mich. (204 m)		Fargo, N. Dak. (274 m)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (410 m)		Murfreesboro, Tenn. (180 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	12	1.3	333	2.1	241	5.5	273	2.9	291	3.4	270	2.2	261	1.0	266	3.0	317	2.0	19	2.3	35	3.5	138	0.4	213	1.0
500	-----	-----	322	4.6	-----	-----	283	9.4	-----	-----	274	6.2	263	4.0	276	6.7	318	6.1	66	2.7	55	7.2	23	0.2	248	3.4
1,000	-----	-----	306	6.3	-----	-----	281	10.2	-----	-----	277	8.7	267	8.4	286	8.4	325	8.5	326	0.7	71	5.4	128	2.0	259	6.4
1,500	-----	-----	290	7.4	273	9.7	285	9.2	-----	-----	271	11.1	275	11.6	282	10.5	313	9.1	297	1.8	80	2.6	141	2.5	267	6.9
2,000	334	0.9	292	9.4	299	10.2	282	11.0	295	7.0	278	12.5	280	10.9	287	8.3	313	11.8	292	3.5	18	0.7	187	1.3	290	8.2
2,500	292	1.7	296	8.7	297	11.2	-----	-----	311	9.6	284	13.4	299	11.7	295	11.3	321	11.5	286	4.3	356	1.2	251	0.7	292	10.1
3,000	284	2.4	280	7.5	302	11.2	-----	-----	318	8.6	291	11.6	293	11.0	294	12.3	-----	-----	285	5.1	308	1.6	290	1.3	296	7.8
4,000	269	4.2	273	10.4	315	10.5	-----	-----	314	8.4	-----	-----	-----	-----	-----	-----	-----	-----	279	5.8	291	4.8	213	3.4	-----	-----
5,000	335	1.3	-----	-----	335	11.2	-----	-----	360	5.7	-----	-----	-----	-----	-----	-----	-----	-----	278	4.7	-----	-----	340	3.2	-----	-----

Altitude (m) m. s. l.	Newark, N. J. (14 m)		Oakland, Calif. (8 m)		Oklahoma City, Okla. (402 m)		Omaha, Nebr. (306 m)		Pearl Harbor, Territory of Hawaii [1] (68 m)		Pensacola, Fla.[1] (24 m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,294 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washington, D. C. (10 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	287	2.4	92	1.1	278	1.0	307	1.6	-----	-----	13	3.5	268	2.3	161	1.5	67	0.6	286	0.8	126	0.5	77	1.4	295	1.1
500	282	7.3	48	2.4	267	1.9	296	3.4	-----	-----	24	2.9	281	5.5	-----	-----	51	1.7	278	2.0	274	.7	-----	-----	283	7.2
1,000	285	10.0	50	2.8	311	4.4	308	8.0	-----	-----	310	2.7	293	8.9	-----	-----	53	2.0	316	5.4	239	2.2	131	1.5	282	9.9
1,500	276	11.0	72	2.7	310	5.1	308	8.0	-----	-----	306	4.0	300	10.2	189	0.9	69	3.7	312	7.7	219	3.2	231	2.4	292	11.9
2,000	275	12.1	114	1.4	295	4.0	308	9.5	-----	-----	315	6.3	292	10.1	215	1.0	64	4.2	331	7.9	238	4.0	270	3.9	286	13.3
2,500	282	15.4	164	4.8	300	4.8	297	9.8	-----	-----	299	6.9	293	9.4	284	1.5	57	4.5	314	10.4	257	4.7	272	6.1	291	14.5
3,000	278	15.0	187	4.0	303	5.6	293	9.4	-----	-----	293	10.6	300	7.9	322	3.8	42	4.7	332	12.1	274	5.5	280	7.7	-----	-----
4,000	-----	-----	195	2.4	296	5.6	281	10.5	-----	-----	273	9.2	304	4.4	307	4.5	32	2.5	-----	-----	-----	-----	294	8.4	-----	-----
5,000	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	7.7	93	1.5	-----	-----	-----	-----	-----	-----	-----	-----

[1] Navy stations.

RIVERS AND FLOODS

[River and Flood Division, W. J. MOXOM, temporarily in charge]

By BENNETT SWENSON

During the month, which was otherwise quite dry, a period of excessive rainfall occurred from the 1st to the 4th in the lower Missouri Basin, the middle Mississippi Basin, the Ohio Basin, and the Lake region. The heaviest rain fell in Indiana and in parts of Illinois and Ohio.

As a result of this rainfall, stages that were quite low at the beginning of the month rose considerably to stages slightly above flood stage, principally in the Wabash River Basin and in tributaries of the middle and lower Mississippi River.

The official in charge of the Weather Bureau office at Indianapolis, Ind., reports as follows on the floods in the Wabash River Basin:

All river stages were very low at the beginning of the month, but a period of excessive rainfall, beginning at most places during the day of November 1 and continuing until the morning of the 3rd caused rapid rises in parts of the upper stretches, and rather slower rises in the lower channels. By far the greater proportion of the excessive rainfall occurred for the most part during the 24-hour period ending at 7 a. m. C. S. T. on November 3. Reports on the morning of November 3 showed excessive rainfall averaging from 3 to 4 inches over the various subdivisions of the basin.

In the recollection of the writer, this flood period was the only one of substantial changes from low to flood or comparatively high stages since his taking charge of the Indianapolis River district in 1914, that occurred throughout the basin, and ran its full course, on a single period of excessive rainfall.

The following account of an unusual rise in the lower Missouri River at Hermann, Mo., where the river rose from 2.1 feet at 7 a. m. of the 2d to 14.1 feet at 7 a. m. of the 3d, was received from the Weather Bureau office, St. Louis, Mo.:

The remarkable rise of 12 feet in 24 hours at Hermann, Mo., November 2–3, equals the previous record for greatest 24-hour rise. It occurred only once before, viz, February 19–20, 1882.

The 24-hour rise of 8.1 feet at St. Louis, Mo., November 3–4, was also quite unusual; but it has been exceeded several times. The greatest 24-hour rise recorded at St. Louis was 13.2 feet on January 3–4, 1897.

Doubtless, greater 24-hour changes would be shown if the 24-hour periods could be taken from any time of day and not confined to the period 7 a. m. to 7 a. m.

Moderate rises occurred in the lower Ohio and middle Mississippi Rivers as a result of the excessive rainfall. The mean stage at Cairo, Ill., on the Ohio River, was 17.4 feet as compared to a 60-year normal of 13.4 feet for the month.

The Santee River in South Carolina was near, at, or slightly above flood stage most of the month. There were heavy rains in South Carolina on the 13th, but most of the excess water was a result of floods during October. As there is a gradual run-off in the low, swamp area of that section.

The amount of loss or damage from the floods of the month was small because the farm crops had been, in the main, harvested.

Stages in the Columbia River Basin were exceptionally low during the month due to the dry summer and fall